CHAPTER 6

ENVIRONMENTAL CONSIDERATIONS

6-1. General.

a. Environmental Impacts. Estuarine modifications are usually intended to improve navigation conditions or provide for flood control. However, these modifications may have short- and long-term impacts on the environment at the site of the control work and both upstream and downstream of the control work. New-work dredging provides access to navigational facilities, and maintenance dredging sustains that access. Impacts of dredging on both water quality and shoaling should be considered. Some modifications are described as follows.

(1) Dredging. Deepening channels often causes increased salinity intrusion, and sedimentation rates and patterns may be changed. Biota in the channel area may be destroyed. Both new-work and maintenance dredging material must be disposed in an environmentally acceptable manner.

(2) Diversion works. Diversion works may cause the salinity in the estuary from which the fresh water is diverted to become essentially as saline as the ocean at the mouth. Also, the salinity in the waterway receiving the diverted flow will decrease. The currents will be accelerated, possibly causing scour of the bed and banks, and shoaling may become a problem in the downstream reaches of the water body receiving the diverted flow.

(3) Hurricane barriers. Hurricane barriers may accelerate shoaling both upstream and downstream and cause tides to rise higher and fall lower on the downstream side. While the tide range may be decreased upstream, the elevation of the mean water level may be increased.

(4) Salinity barriers. These barriers may cause tides to rise higher and fall lower downstream of the barrier, cause shoreline properties to be inundated to an extent, and decrease navigation depths at low tide. Shoaling may become more serious both upstream and downstream of the salinity barrier.

b. Reporting Requirements. Because of the possible environmental impacts, both new projects and operation and maintenance activities must be consistent with national environmental policies. In general, these policies require creation and maintenance of conditions under which human activities and natural environments can exist in productive harmony including preservation of historic and archeological resources. Corps project development is documented by a series of studies, each more specific than the previous one. The series of reports produced for a given type of project often evolves due to changing regulations. However, in general, the environmental impacts of the project must be included in all reports prepared prior to Congressional project authorization. (Refer to EM 1110-2-1202 for a description of this process.)

c. Statutes and Regulations. Compliance with Federal statutes, Executive guidelines, and Corps regulations often requires studies of existing environmental conditions and those likely to occur in the future with and without various activities. EM 1110-2-1202 lists the major environmental statutes and regulations that are currently applicable to Corps waterway projects. Four statutes that have a major impact on the planning and operation of projects in estuaries are the Estuary Protection Act, the National Environmental Policy Act, the Clean Water Act, and the Marine Protection, Research and Sanctuaries Act. There are also State and local regulations that must be satisfied.

(1) Estuary Protection Act. With this act Congress declared that many estuaries in the United States are rich in a variety of natural, commercial, and other resources, and it is declared to be the policy of Congress to recognize, preserve, and protect the responsibilities of the States in protecting, conserving, and restoring the estuaries in the United States.

(2) National Environmental Policy Act (NEPA). NEPA is the Federal statute that established national policy for the protection of the environment and set goals to be achieved along with the means to carry out these goals. This act requires preparation of an Environmental Impact Statement (EIS) for certain Federal actions affecting the environment in accordance with US Environmental Protection Agency (EPA) implementing regulations for NEPA. Environmental assessments (EA) are prepared for all other Corps actions that may not have a significant impact on the environment except for certain minor actions that are categorically excluded from NEPA review. Emergency activities do not require the preparation of an EIS.

(3) Clean Water Act. Section 404 of the Clean Water Act governs the discharge of dredged or fill material into waters of the United States. The evaluation of the effects of discharge of dredged or fill material should include consideration of the guidelines developed by EPA.

(4) Marine Protection, Research and Sanctuaries Act (MPRSA). The MPRSA governs the transport of dredged material for the purpose of ocean disposal. Title I of the MPRSA, which is the Act’s primary regulatory section, authorizes the Secretary of the Army acting through the Corps (Section 103) to establish ocean disposal permit programs for dredged materials. In addition, Section 103(e) requires that Federal projects involving ocean disposal of dredged material shall meet the same requirements as developed for permits.

d. Environmental Study Management. At each stage of a project, efforts should be made to identify key environmental concerns and corresponding future information needs. Adequate forecasting of data needs is necessary to schedule adequate time for such activities as field data collection and physical or numerical modeling. Scheduling for work by others should allow for administrative procedures such as contractor selection, review procedures, and potential delays.

(1) Critical issues. Time and money constraints preclude detailed investigations and data collection for every area of interest; therefore, the most critical issues should be identified. It is essential that the number of factors assessed be adequate to fully account for all significant effects. The addition of other factors to be considered will increase the time, funds, and expertise required for the study. Therefore, a proper balance between adequate analysis and study resources must be achieved. Criteria for determining the importance of an issue include, but are not limited to, statutory requirements, Executive orders, agency policies and goals, and public interest. Federal regulations must be followed when determining the scope of an EIS.

(2) Environmental data. Environmental data collection is discussed in Paragraph 6-5. Well-defined, detailed objectives must be established prior to data collection. The design for the investigation should include a rationale for variable selection, sampling locations and frequencies, data storage and analysis, and hypotheses to be tested.

(a) Environmental studies during the preliminary stages of project development should emphasize identification of resources, development of an evaluation framework, and collection of readily available information for all potential alternatives. Resources likely to be impacted are evaluated, and further information needs are identified.

(b) Detailed analysis normally occurs after two or three specific alternatives have been selected for further study. The major emphasis of environmental studies in the detailed assessment stage should be directed toward identifying, describing, and appraising individual effects and evaluating the net effects of each alternative. Both positive and negative environmental effects should be characterized in adequate detail so they can be used along with the economic and technical analyses to compare alternatives.

6-2. Water Quality Considerations.

a. General. The impacts of estuarine control works on water quality can be categorized as follows:

(1) Impacts from dredging and disposal during construction and maintenance.

(2) Altered circulation caused by changes in geometry.

(3) Increased pollutant loadings due to facility construction and accidental vessel discharges or spills.

(4) Salinity changes.

Industrial and municipal effluents and agricultural runoff with attendant problems of low dissolved oxygen (DO), eutrophication, or toxic contamination are not primary Corps concerns unless Corps activities have the potential to

mitigate or intensify already existing water quality problems. However, these conditions and the potential for water quality problems should be identified and documented in the early project stages.

b. Dredging and Disposal. The major water quality considerations of dredging and dredged material disposal are directly related to the amount of contaminants present and the mobility of the contaminant into environmental pathways by biological or hydrodynamic processes. The chemistry of contaminants in sediments is controlled primarily by the physicochemical conditions under which the sediment exists. Fine-grained sediments are typically anoxic, chemically reduced, and nearly neutral in pH. The effect of disposal environments on these chemical characteristics is an important consideration in the selection of disposal options. If sediment is disposed in an aquatic environment, sediment chemistry may not change. However, transfer of the sediment to a dryer environment, such as an upland disposal site, may change the chemistry to an anoxic and lower pH condition more favorable to the release of contaminants. Biological and physical processes may also affect the release of contaminants at a disposal site. Different contaminants and sediments with different properties do not always respond to an altered biological or physicochemical condition. This would mean that contaminant release would be a site-specific process and would be difficult to predict. Procedures are available for evaluating the environmental impacts of three major disposal alternatives: open water, intertidal, and upland methods (see Paragraph 6-4). Water quality considerations for dredging and disposal operations are summarized in the Dredged Material Research Program Synthesis of Research Results report series. An index of these reports is given in Herner and Company (1980). For detailed information on water quality considerations during dredging, refer to EM 1110-2-5025.

c. Altered Circulation.

(1) Circulation may be altered as a result of modifications to an estuary, its tributaries, or its sea connection. Changes in circulation may result in changes in the spatial distribution of water quality constituents, in the flushing rates of contaminants, and in the pattern of scour and deposition of sediments.

(2) Environmental assessment of the effects of changes in circulation should initially emphasize the physical parameters such as salinity, temperature, and velocity and their impacts on plant and animal communities. These initial analyses should consider changes in vertical stratification when deepening of a channel is proposed. Increased density stratification inhibits vertical mixing, which may result in depletion of DO in bottom waters. If minimal changes occur in these parameters, then it can be generally assumed that the chemical characteristics of the system will not change significantly. This approach is based on a methodology that permits assessment without requiring extensive data and knowledge of the processes affecting the water quality constituent of direct interest. However, this approach is invalid if preliminary water quality surveys indicate the existence of toxic constituents at concentrations potentially damaging to biotic populations. Prediction of

change in circulation and its effect on the physical parameters can be achieved through comparison with existing projects, physical model studies, and numerical simulation.

d. Pollutant Loadings. Increased pollutant loadings may result from facility construction, vessel discharges, and accidental spills. Increased navigational traffic as a result of estuarine modifications may also increase contaminant release through either accidental spillage of toxic cargoes, vessel discharges, or short-term alterations in ambient estuarine hydraulic conditions (propagation of waves, generation of currents, drawdown, and pressure and velocity changes) that may resuspend bottom sediments. Resuspended bottom sediments temporarily increase turbidity and total suspended solids concentrations. Generally, photosynthesis does not decrease and may even increase because of the release of nutrients from suspended fine sediments. Resuspension of fine sediments may decrease DO by increasing oxygen demand. The additive effect of increased navigation traffic may be to maintain high levels of solids and turbidity, which could have a permanent effect on the estuarine water quality. Also modifications may result in increased industrial development, which may result in industrial effluents, spills, and contaminated surface runoff entering the estuary. All of these factors should be considered when determining the possible increase in pollutant loadings and the impact it may have on the estuarine water quality.

e. Salinity Changes. Changes in salinity may result from the construction of estuarine control works or channel deepening. Construction and operation of locks may cause salinity intrusion in upstream portions of estuaries normally used for freshwater supplies. Also, diversion works may cause normally freshwater portions of an estuary to become saline or vice versa. If these freshwater supplies are used for municipal, agricultural, or industrial purposes, then the prevention of salinity intrusion can be a controlling factor in designing the estuarine control work project. Estuarine ecological features may also be influenced by a reduction in salinity as a result of barriers or diversion structures. The decrease in salinity may be detrimental to a seafood industry, affecting such estuarine ecological features as oyster beds or fish and shrimp nurseries. Consideration should be given to both short- and long-term changes in salinity during all seasons of the year, as these changes can have a drastic effect on sensitive ecological features.

6-3. Biological Considerations.

a. General. The effects of estuarine modifications on plants and animals may result from the physical changes in habitat due to the enlargement of channels, disposal of dredged material, and the construction of various control works. Other effects may result from changes in contaminant levels, turbidity, suspended sediments, salinity, circulation, and erosion. Preliminary research suggests that navigation traffic itself affects certain species. Weather and large storm events, such as hurricanes on the Gulf Coast, can devastate an estuary in a short period of time. These effects on habitat in the estuary may be short- and long-term physical changes.

b. Reference. This and other considerations have already been addressed in EM 1110-2-1202. It should also be noted that the EM contains a glossary of the scientific terms, some of which are used in this EM.

6-4. Dredging Effects Considerations.

a. General. Dredging is a major activity in the development or improvement of navigation and flood-control projects in estuaries. During the design phase of such projects, the environmental effects associated with dredging and dredged material disposal must be considered. The primary short-term objective of a dredging project is to provide authorized project dimensions. This should be accomplished using the most technically satisfactory, environmentally compatible, and economically feasible dredging and dredged material disposal procedures. Long-term dredging objectives concern the efficient management and operation of dredging and disposal activities during continued operation and maintenance of the project. The environmental considerations required to support the design of new-work or maintenance dredging projects are outlined in the following paragraph.

b. Basic Considerations. In order to consider the environmental aspects of dredging and dredged material disposal in the design phase of a project, the activities listed in Table 6-1 are required. Although dredging and related matters have traditionally been considered an operations and maintenance function, a well-coordinated approach in the planning and design stages can minimize problems in the operations and maintenance of the project. This is especially true regarding long-range planning for disposal of both new-work and maintenance dredged material. For a more complete discussion, along with disposal alternatives, habitat development, and associated uses (such as recreation and aesthetics, etc.) refer to EM 1110-2-1202 and EM 1110-2-5026.

6-5. Environmental Data Collection and Analysis. In the process of planning and designing estuarine navigation projects, potential environmental impacts must be assessed. This is done through very detailed and site-specific data collection efforts. However, some basic requirements are common to all data collection programs.

6-6. Mitigation Decision Analysis.

a. Policy. Care must be taken to preserve and protect environmental resources, including unique and important ecological, aesthetic, and cultural values. The Fish and Wildlife Coordination Act of 1958 (PL 85-624, 16 U.S.C. 61, et seq.) requires fish and wildlife mitigation measures when justified. Specific mitigation policy for significant fish and wildlife and historic and archeological resources is included in ER 1105-2-50, Chapters 2 and 3. Damage from Federal navigation work along the shorelines of the United States must be prevented or mitigated.

TABLE 6-1

Basic Considerations

Step	Information Source
Analyze dredging location and quantities to be dredged	Hydrographic surveys, project maps
Determine the physical and chemical characteristics of the sediments	WES TR DS-78-10 (Section 6-8) (Palermo, Montgomery, and Poindexter 1978)
Determine whether or not there will be dredging of contaminated sediments	WES TR DS-78-6 (Brannon 1978)
Evaluate disposal alternatives	EM 1110-2-5025
Select the proper dredge plant for a given project	EM 1110-2-5025
Determine the levels of suspended solids from dredging and disposal operations	WES TR DS-78-13 (Barnard 1978)
Control the dredging operation to ensure environmental protection	WES TR DS-78-13 (Barnard 1978)
Identify pertinent social, environmental, and institutional factors	Paragraph 6-1
Evaluate dredging and disposal impacts	WES TR DS-78-1 (Wright 1978); WES TR DS-78-5 (Hirsch, Di Salvo, and Peddicord 1978)

b. Types of Mitigation. Based on the Council on Environmental Quality (CEQ) definition, mitigation includes:

(1) Avoiding the impact altogether by not taking a certain action or parts of an action.

(2) Minimizing impacts by limiting the degree of magnitude of the action and its implementation.

(3) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.

(4) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.

(5) Compensating for the impact by replacing or providing substitute resources or environments.

c. Justification for Mitigation. Justification of mitigation measures shall be based on the significance of the resource losses due to a plan, compared to the costs necessary to carry out the mitigation (ER 1105-2-50, 2-4C.1). Extent of mitigation justified will ultimately be determined through negotiation with the US Fish and Wildlife Service and the concerned state. Endangered and threatened species and critical habitats will be given special consideration.

d. Resources Impacted. Impacts from dredged material disposal and hydraulic changes affect primarily shorelines, wetlands, vegetated shallows, and riparian zones. These areas will usually be composed of or considered to be significant resources. Appendix C of ER 1105-2-50 (Subparts C-F) describes potential impacts on these resources.

e. Key Concepts for Mitigation.

(1) Early Participation. To determine significant resource losses that will occur because of a project, environmental personnel must be involved in the project from the beginning. Once such potential losses are identified, the project can be modified to reduce or eliminate them. If modification is inadequate or infeasible, measures to offset the losses should be developed. Through early participation, the definition of mitigation can serve as a sequence of steps to follow.

(2) Long-term planning. Hershman and Ruotsala (1978) suggest building mitigation into a long-term estuary management plan, such that development and environmental protection proceed simultaneously. This approach allows cumulative impacts to be mitigated, decreases time and cost per project, and spreads the mitigation burden more equitably.

(3) Mitigation planning goals. Four options for mitigation efforts are summarized as follows:

(a) In-kind: resources physically, biologically, and functionally similar to those being altered.

(b) Out-of-kind: resources as above, dissimilar.

(c) Onsite: occurring on, adjacent to, or in the immediate proximity of the project site.

(d) Offsite: occurring at a point away from the project site.

A guide to selecting any combination of (a) or (b) and (c) or (d) as a mitigation option is found in US Fish and Wildlife Service (1980) in which resource categories, attendant mitigation goals, and mitigation measures are suggested.

6-7. Checklist of Environmental Studies.

a. The following checklist consists of some of the environmental factors that should be considered for estuarine navigation projects. This checklist is cumulative, and not all studies are appropriate for all projects.

(1) Characterization of existing conditions at project site.

(2) Estimation of construction activities by others likely to be associated with Federal project.

(3) Evaluation of project effects on circulation patterns and stage variations.

(4) Evaluation of project effects on water quality.

(5) Characterization and testing of sediments to be dredged (Section 404 or 103 evaluation as appropriate).

(6) Analysis of dredging alternatives (dredge plant, timing, etc.).

(7) Analysis of disposal alternatives.

(8) Evaluation of project effects on sedimentation rates and shoaling locations.

(9) Analysis of effects of winter navigation if ice coverage will occur.

(10) Evaluation of aesthetic, cultural, and recreational aspects.

(11) Coordination with other agencies, the public, and private groups.

(12) Planning and design of monitoring programs.

b. For a more complete discussion of this checklist, refer to EM 1110-2-1202.